

# Cardiac Auscultation

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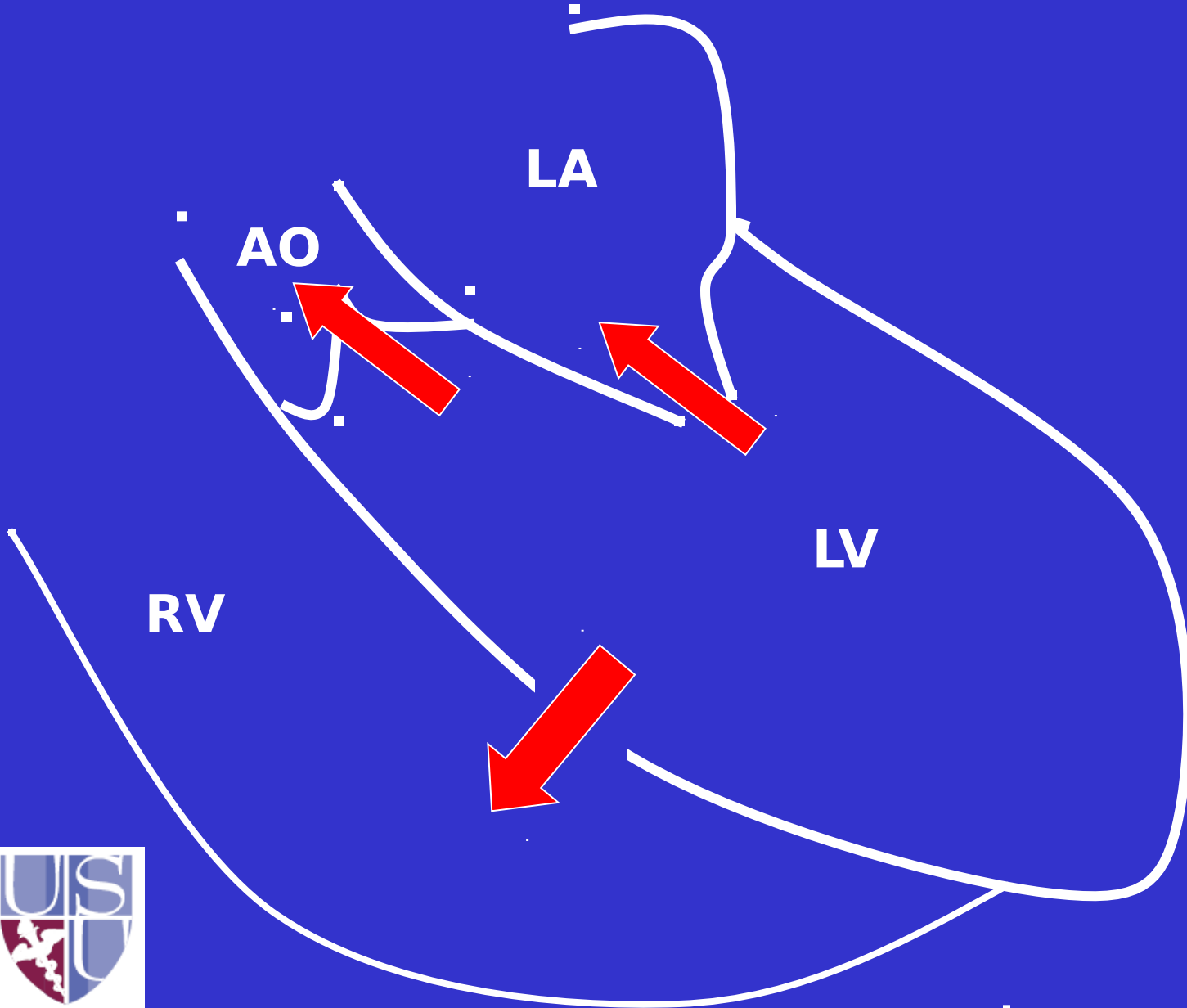


# Third Heart Session

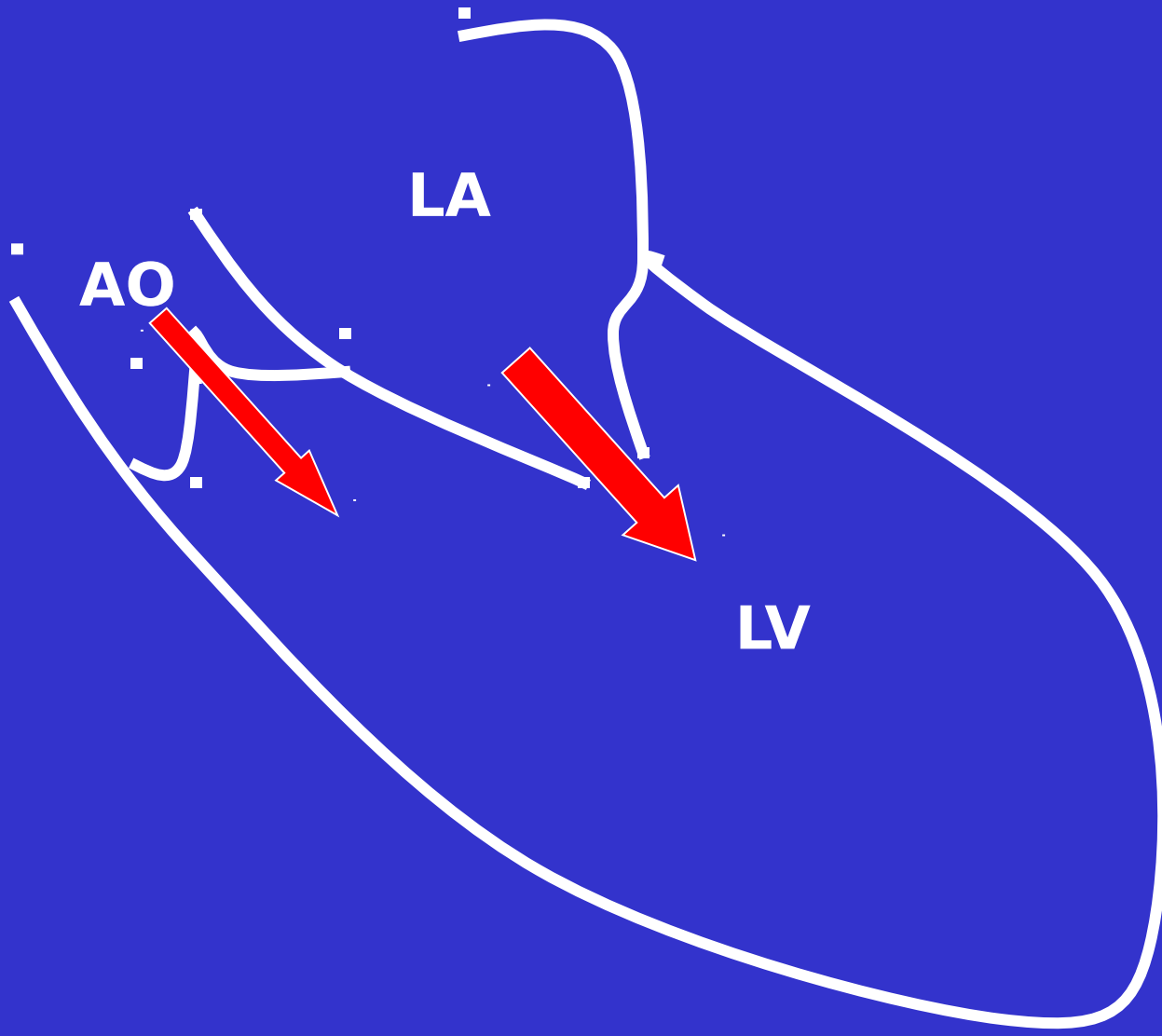
- Questions
- To and fro vs. continuous murmurs
- Cyanotic lesions
- Examination of carotids and JVP
- The Cardiac Exam

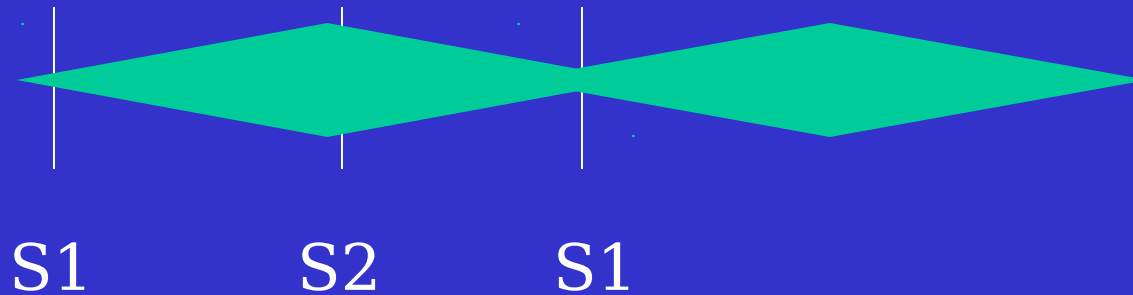


# Systole

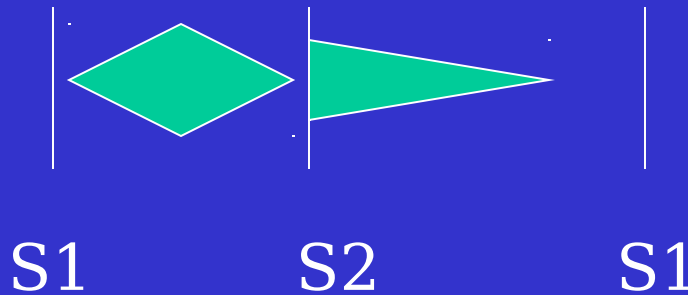


# Diastole





**Continuous Murmur**



**"To and Fro" Murmur**

**Continuous murmur does not pause at S1 or S2;  
the end of systole into diastole.**



# Continuous Murmur

- Implies pressure gradient that is present throughout systole and diastole
  - i.e. pressure gradient never zero
- Artery-artery fistula (I.e. PDA, coronary-PA fistula)
- Arteriovenous Fistula
- Mammary Souffle

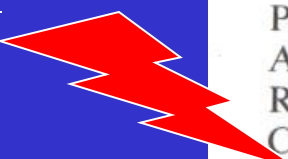


Venous Hum



TABLE 6-2.—LIST OF CARDIOVASCULAR ABNORMALITIES WHICH MAY BE ASSOCIATED WITH CONTINUOUS MURMURS\*

*Acyanotic Cardiovascular Disease*



Patent ductus arteriosus  
Aortopulmonary septal defect  
Rupture of aortic aneurysm into pulmonary artery  
Coronary arterial fistula (Roos *et al.*, 1970)  
Ruptured aneurysm of sinus of Valsalva  
Constriction of a main pulmonary artery  
    Congenital  
    Secondary to thromboemboli (Claudio *et al.*, 1970)  
        or compression by aortic aneurysm (Schrire *et al.*, 1963)  
        or lymph node enlargement (Levin and Booth, 1960)  
Coarctation of aorta  
Arteriovenous fistulas in general  
    Systemic  
    Pulmonary  
Mammary souffle  
Constriction of peripheral artery  
Mitral stenosis combined with atrial septal defect (Aykent *et al.*, 1965)  
Venous hum

*Cyanotic Congenital Heart Disease*

Total anomalous pulmonary venous drainage into superior vena cava or right atrium  
Truncus arteriosus  
Tetralogy of Fallot  
Pulmonary and tricuspid atresia  
After Blalock's or Potts' shunt operation

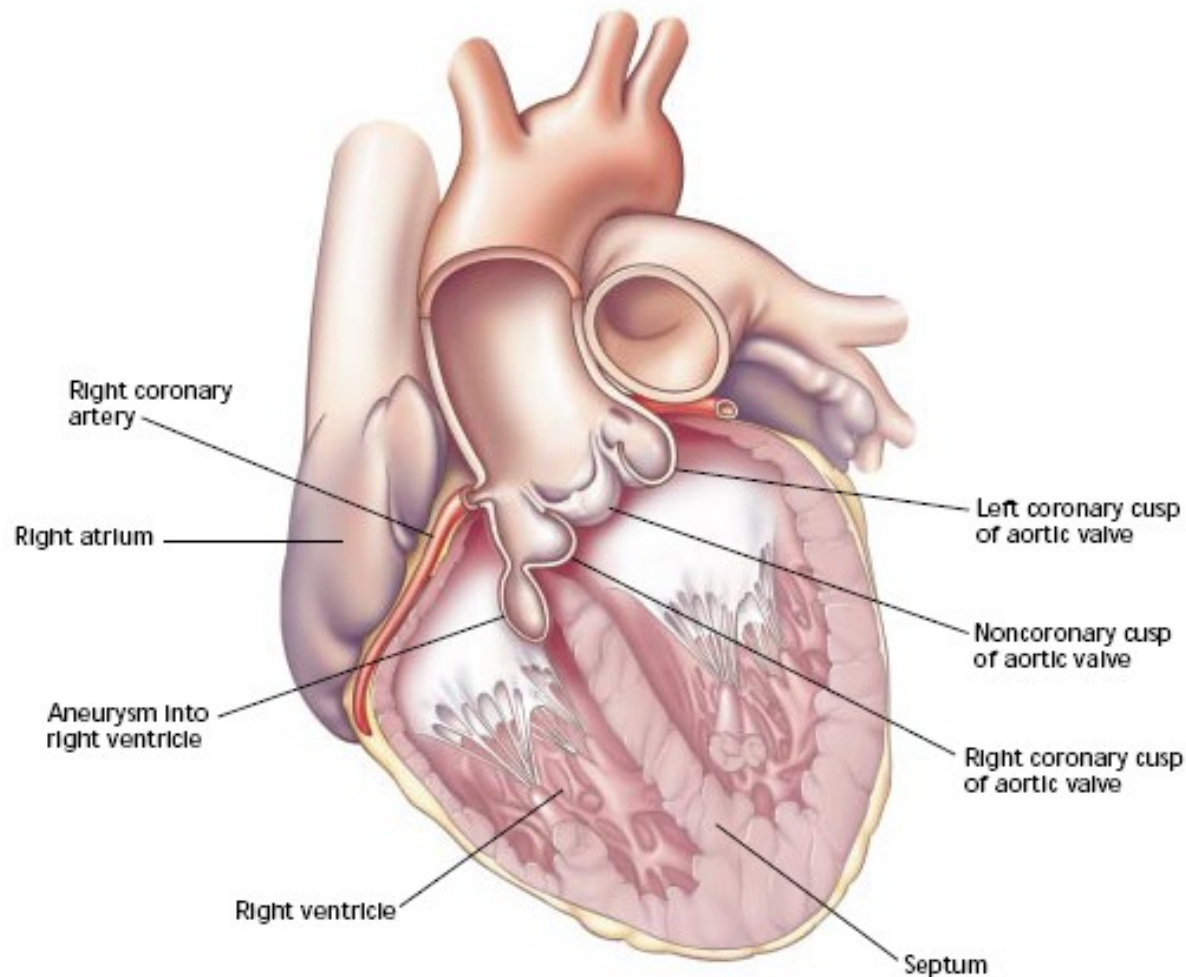
\*Adapted from Ongley, 1964.





# Sinus of valsalva aneurysm and rupture

## ■ Aneurysm of the sinus of Valsalva

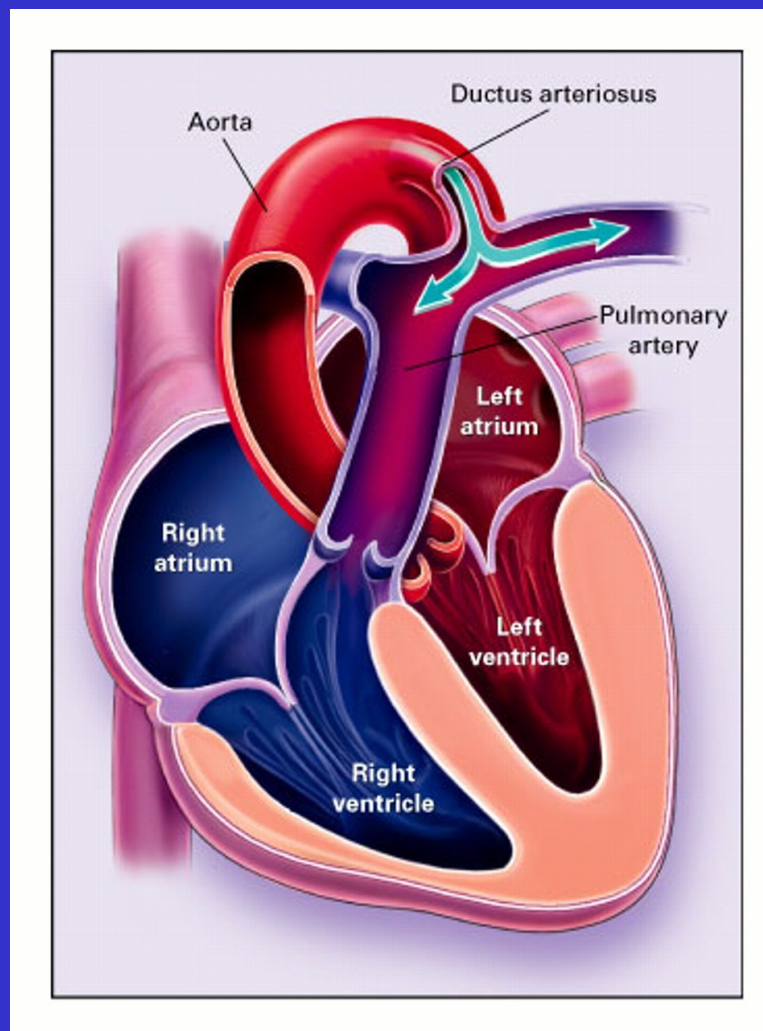


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**FIGURE 1.** Aneurysm of the sinus of Valsalva occurs where a lack of fusion exists between the aortic media and the annulus fibrosis of the aortic valve. Most aneurysms that originate in the right coronary sinus rupture into the right ventricle, producing left-to-right shunting, as seen in **FIGURE 2**.



## Patent Ductus Arteriosus with Resultant Left-to-Right Shunting



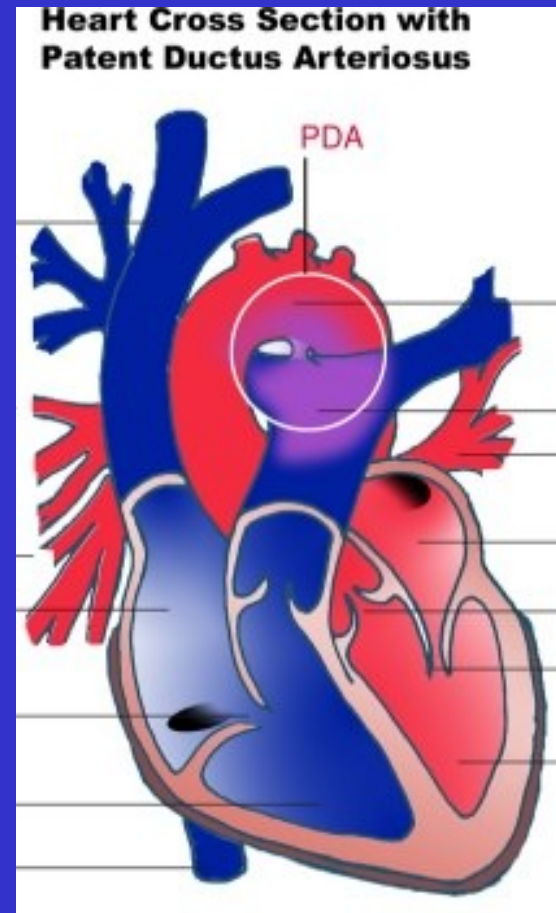
Brickner, M. E. et al. N Engl J Med 2000;342:256-263



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# Patent Ductus Arteriosus

- Remnant of fetal circulation
- If small shunt, may be tolerated for decades
- Large shunt results in pulmonary hypertension, right-to-left shunt
  - “differential cyanosis”
  - Toes blue but fingers pink





# “To and Fro” Murmur

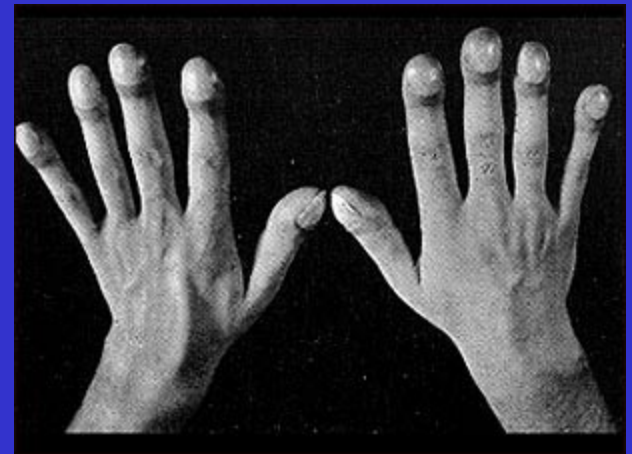
- Brief pause to murmur present
- Implies that the pressure is equalized between two chambers at the end of systole
- Aortic stenosis and regurgitation
- Mitral stenosis and regurgitation





# Cyanotic Lesions

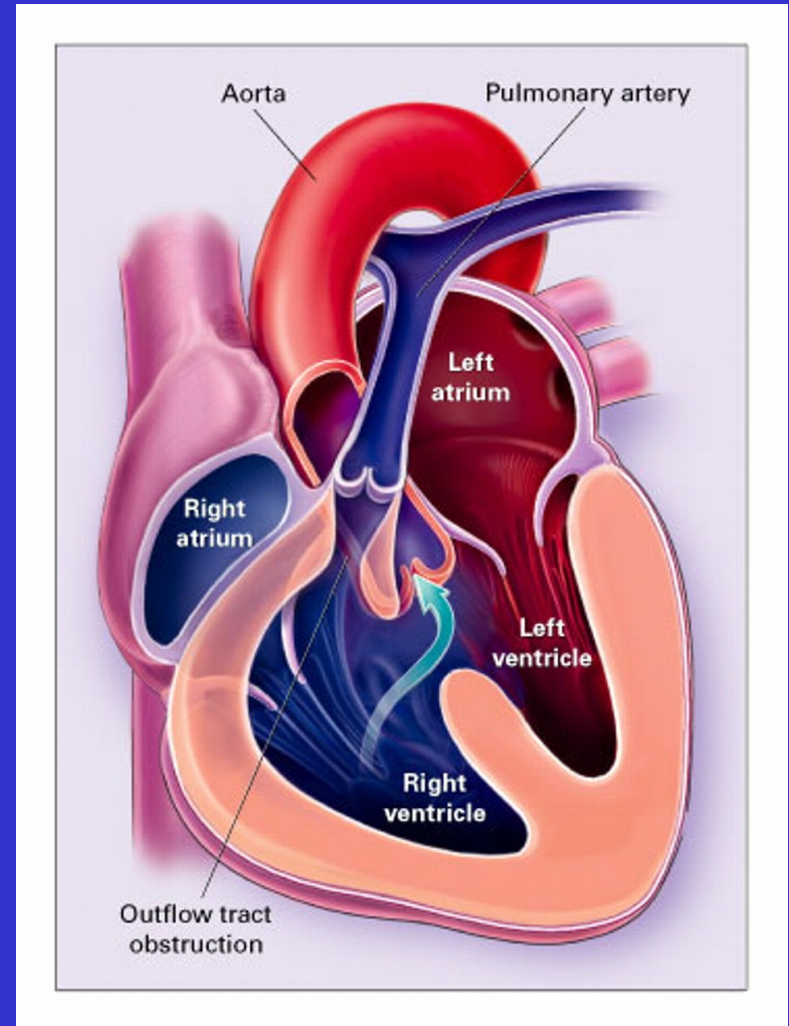
- Implies right to left shunt
- Children
  - Tetralogy of Fallot
  - Transposition of the great vessels
  - Tricuspid atresia
  - Total anomalous pulmonary venous return
  - Truncus arteriosus
- Adults
  - Eisenmenger's syndrome





## Tetralogy of Fallot

- 5/10k births
- Ventricular septal defect
- Narrowing of the pulmonary outflow tract
- Over riding aorta
- right ventricular hypertrophy



Brickner, M. E. et al. N Engl J Med 2000;342:334-

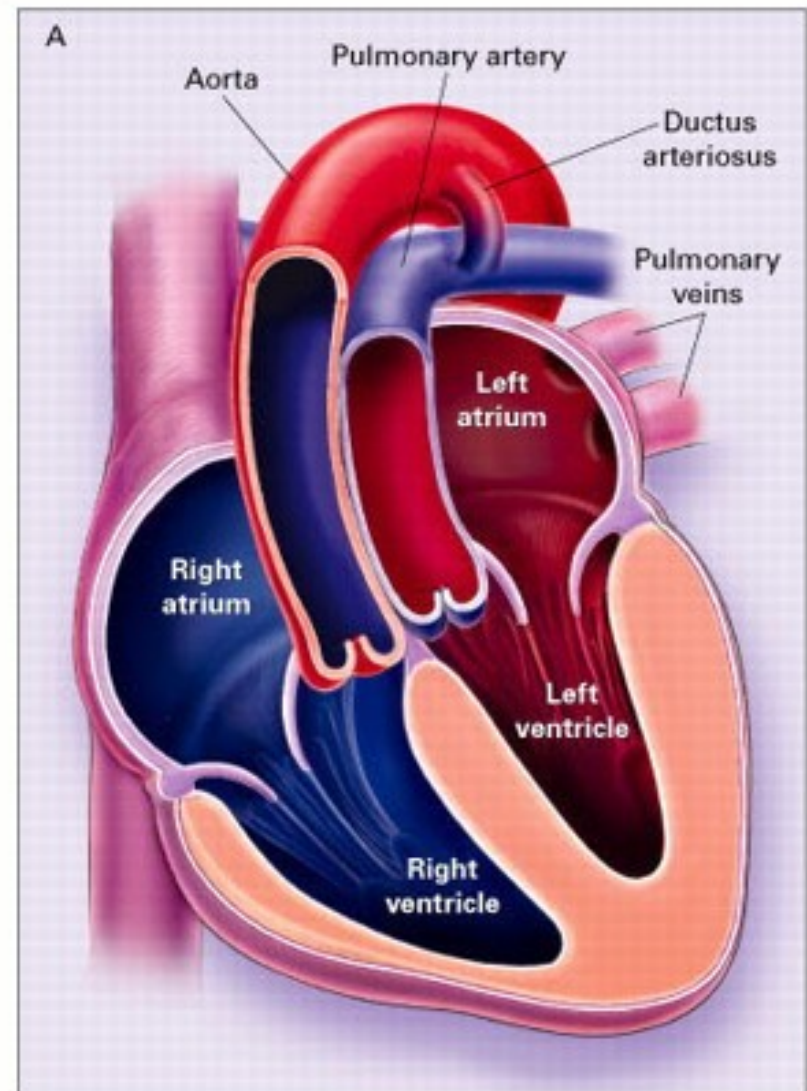


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## Transposition and Switching of the Great Arteries

- Uncorrected form not compatible with life without a shunt
- “Congenitally corrected” form often not cyanotic but associated with severe TR, eventual RV failure



Bricker, M. E. et al. N Engl J Med 2000;342:334-342



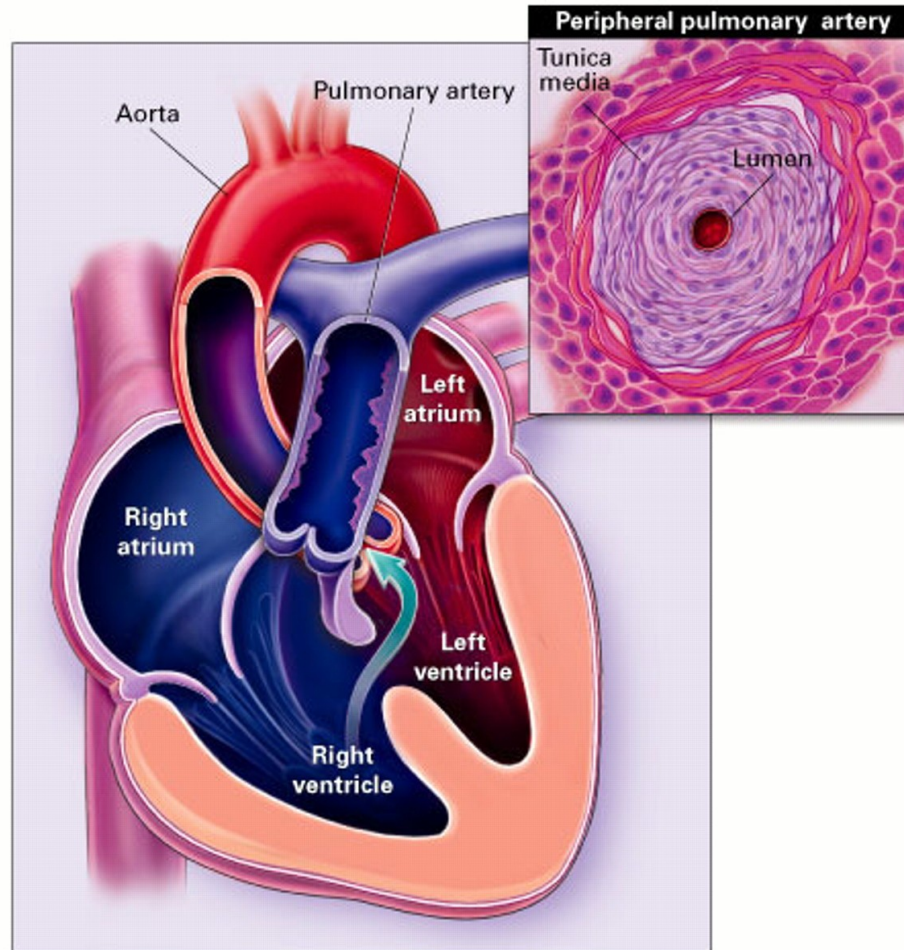
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# Eisenmenger's Syndrome

- Chronic overload of pulmonary circulation due to left-to-right shunts (VSD, PDA, ASD) causes pulmonary hypertension
  - Murmur may disappear as PA pressures rise
  - Sclerosis of pulmonary arterioles
  - “Fixed” pulmonary hypertension
  - Right-to-left shunt with cyanosis
    - Polycythemia, stroke, hemoptysis, endocarditis



# Eisenmenger's Syndrome



Brickner, M. E. et al. N Engl J Med 2000;342:334-342

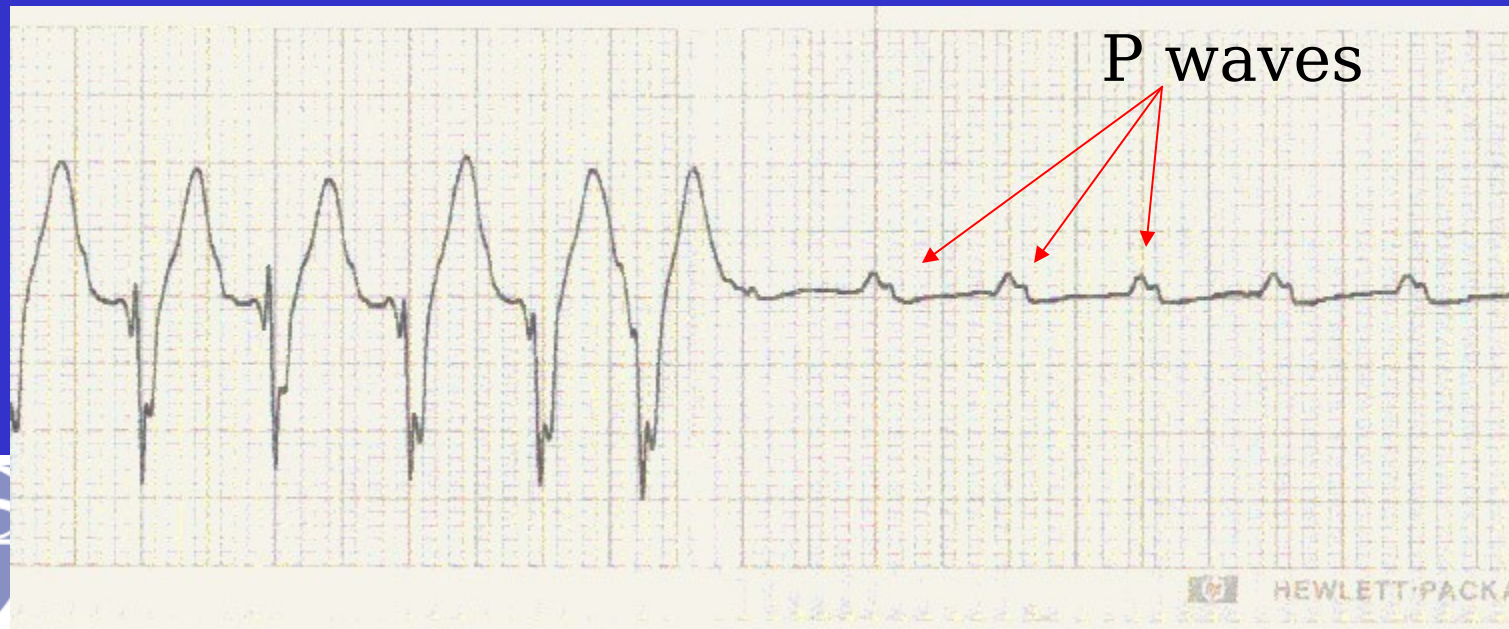


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# Carotids

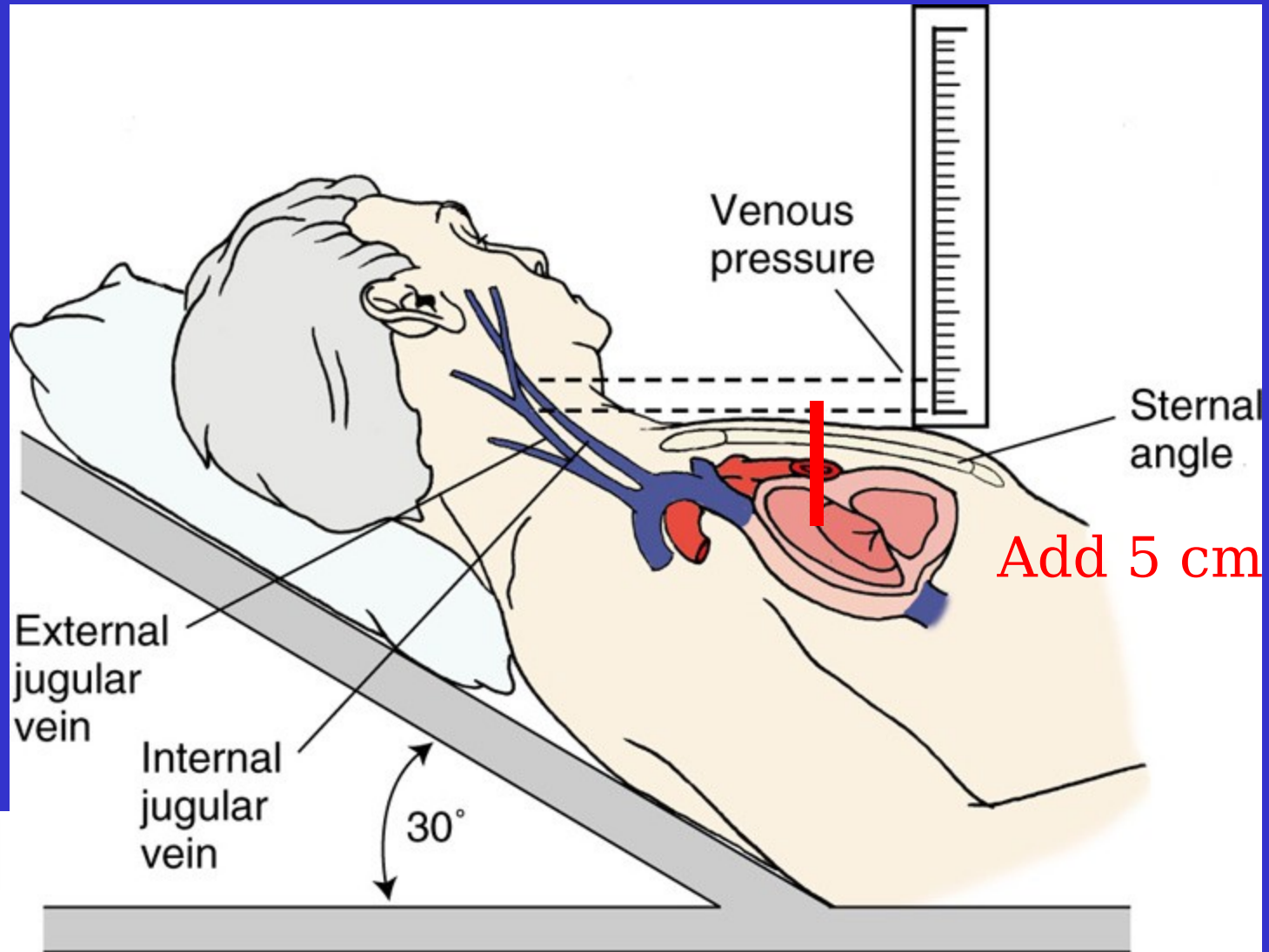
- Listen first
- Press gently in the elderly







# Jugular Veins



# Minimum Cardiac Exam

## Patient Sitting Upright

Inspect from straight ahead or right side

Is patient comfortable? Tachypneic? Restless?

## Vitals!

Tachycardia?

Rhythm regular, irregular, irregularly irregular?

Neck veins flat?

Carotid upstrokes, listen

Lean forward

Chest

Supplement exam as necessary- look for radiation, do maneuvers





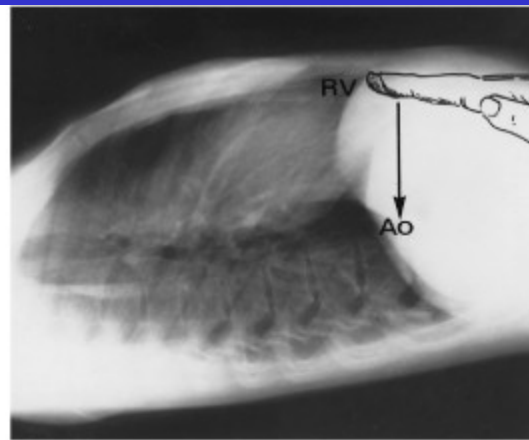
# Minimum Cardiac Exam

- **Supine**
- **Palpate precordium - heaves?**  
**Thrills? PMI-less than quarter?**
  - **Listen to all 4 locations (and points in between) with diaphragm, then bell, then lay in L lateral decubitus. Palp carotid for timing**
  - **Palpate other pulses**





A



B



C



D



E



F



# **Minimum** Cardiac Exam

- Document everything- "Not documented, not done"



# What if you hear something?

- **When** does it occur? Is it systolic, diastolic, or both?
  - **What** is the pattern?
- **Where** is it loudest?
- **Where** does it radiate?
- **Who goes with it?** Are there other associated findings?
  - S2 splitting normal, loud P2, gallop sound?

**How does it respond? Maneuvers**



MS

MR/TR/VS

AS with ES

PS with ES

AR

MS with OS

PDA

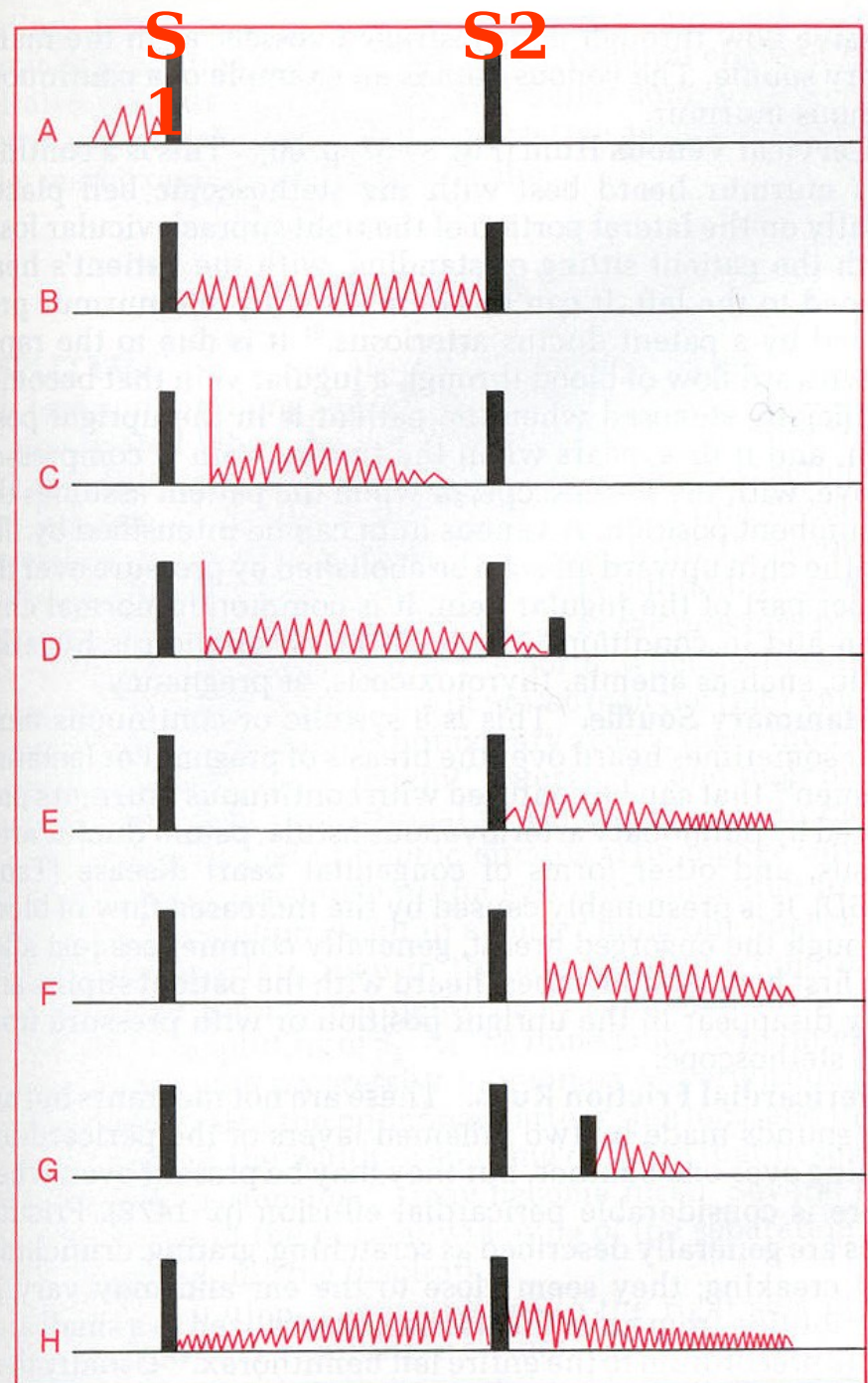
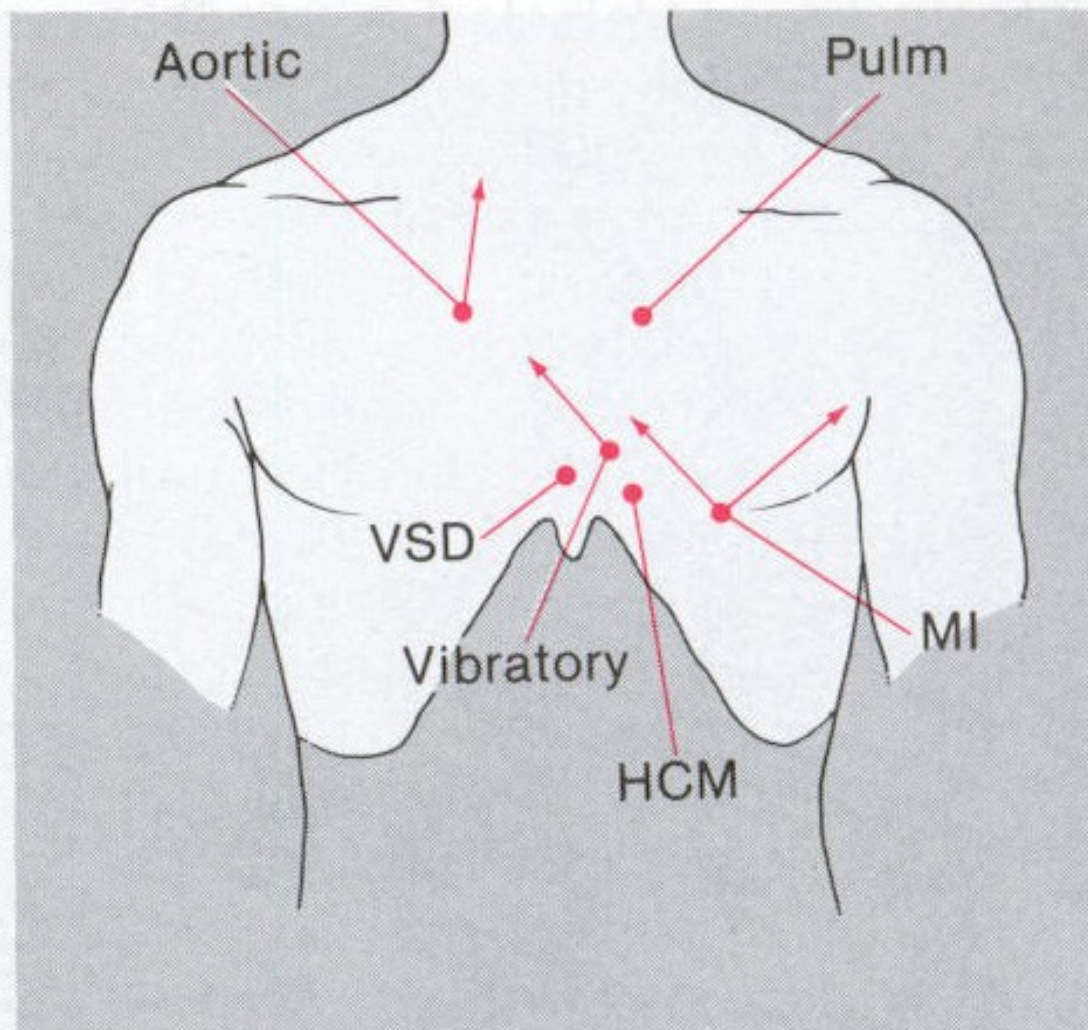


FIGURE 2-24. Diagram depicting principal heart murmurs:  
A, Presystolic murmur of mitral or tricuspid stenosis.  
B, Pansystolic murmur of mitral or tricuspid incompetence or of ventricular septal defect.  
C, Aortic ejection murmur beginning with an ejection click and fading before the second heart sound.  
D, Systolic murmur in pulmonic stenosis spilling through the aortic second sound, pulmonic valve closure being delayed.  
E, Aortic pulmonary diastolic murmur.  
F, Long diastolic murmur of mitral stenosis following the opening snap.  
G, Short mid-diastolic inflow murmur following a third heart sound.  
H, Continuous murmur of patent ductus arteriosus. (From Wood, P.: Diseases of the Heart and Circulation. Philadelphia, J. B. Lippincott, 1968, p. 75.)





**FIGURE 2-20.** Maximal intensity and radiation of six isolated systolic murmurs. HCM = hypertrophic cardiomyopathy; MI = mitral incompetence; Pulm = pulmonary; VSD = ventricular septal defect. (From Barlow, J. B.: *Perspectives on the Mitral Valve*. Philadelphia, F. A. Davis, 1987, p. 140.)



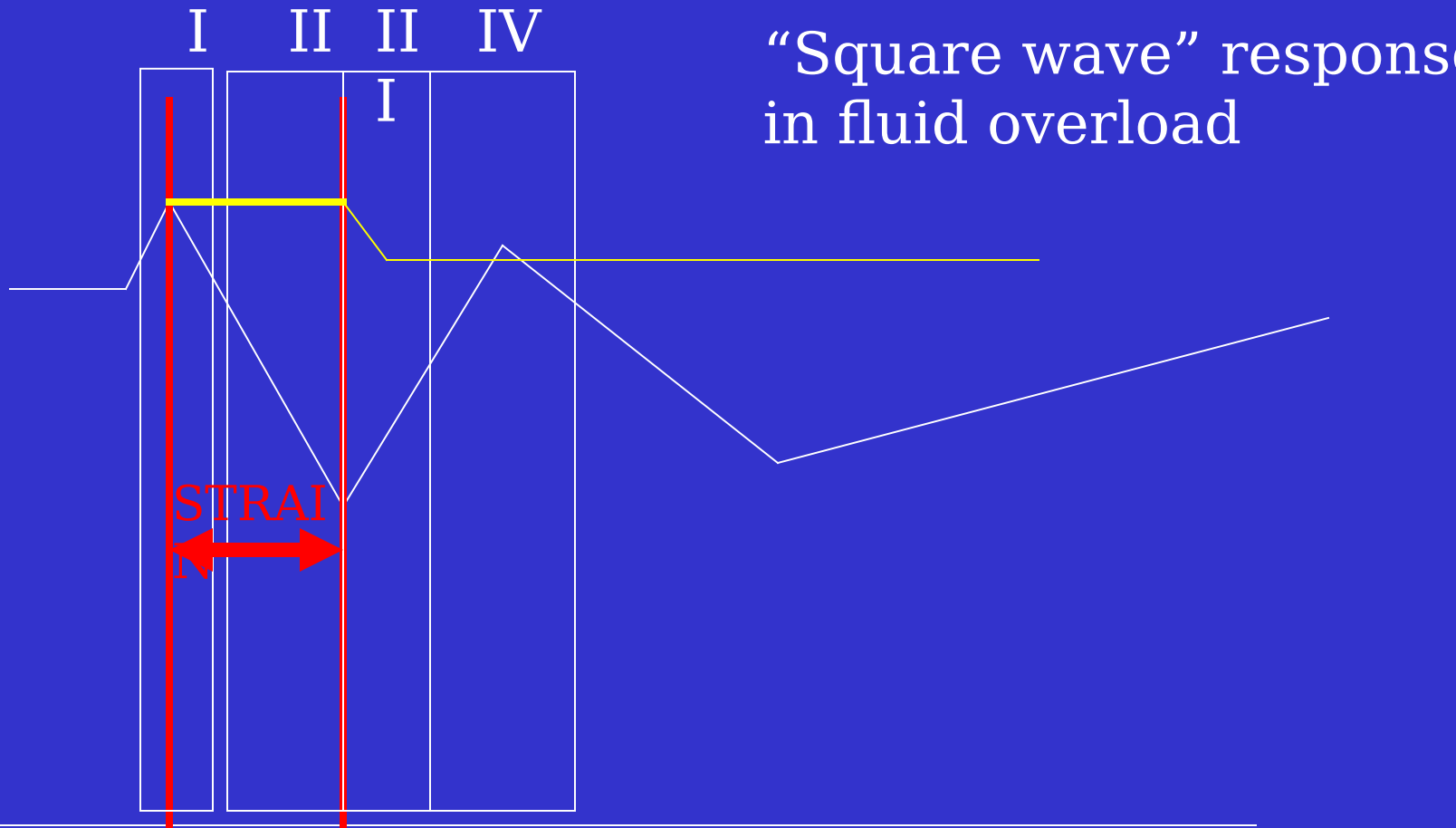
# Maneuvers

- Use normal physiology to probe lesions
- **Valsalva**
  - Causes reduction in venous return to R heart, eventually left heart during prolonged strain
  - Useful for differentiating valvular AS from HOCM
  - rheumatic MR will fade, while MVP may become more prominent



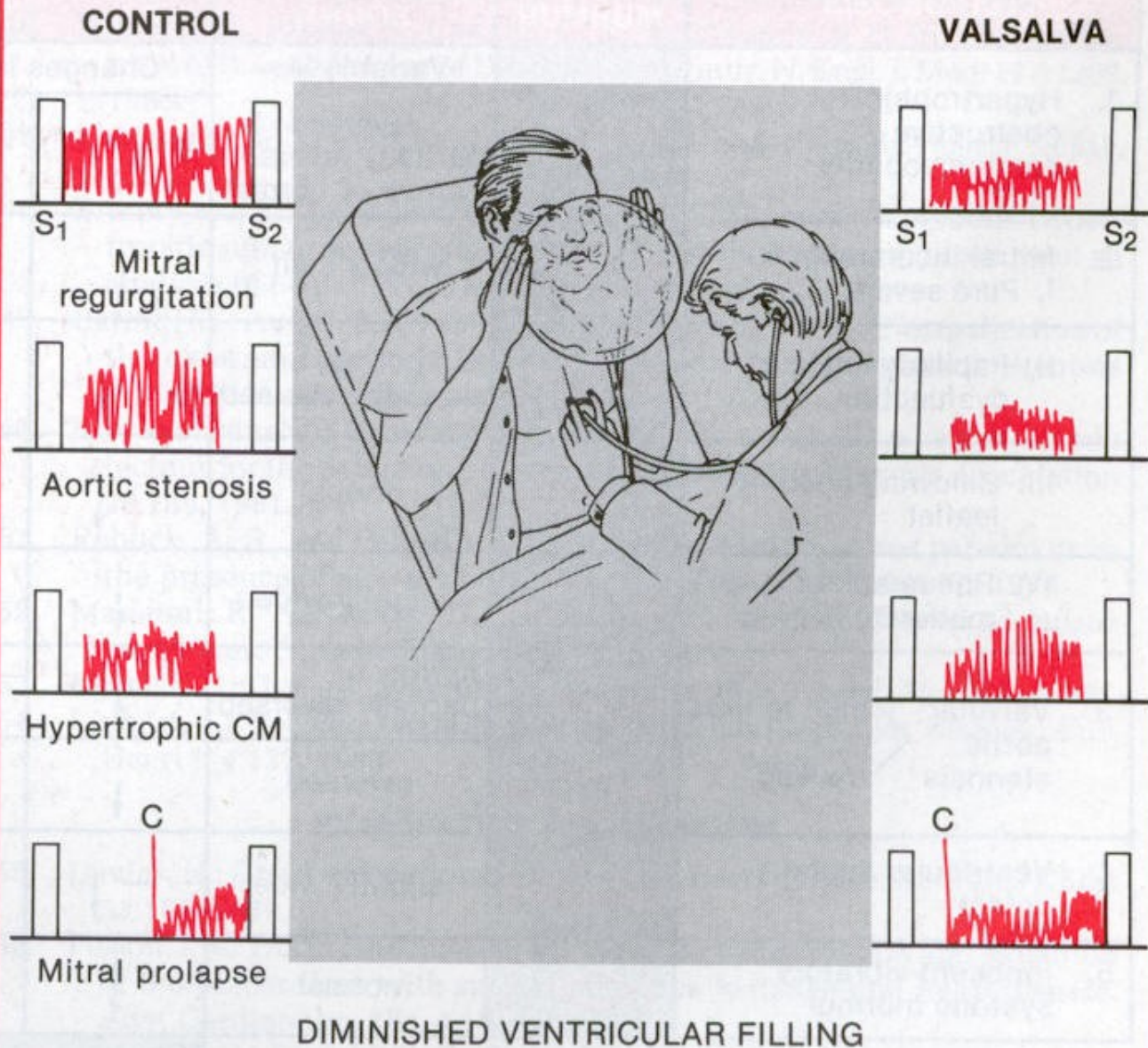
# Valsalva: 4 Phases

Mean Systolic BP





# THE VALSALVA MANEUVER



# Valsalva gone wrong



# Maneuvers

- Standing and squatting
- Standing reduces venous return and systolic BP
  - Decreases AS and MR murmurs, increases HCM and MVP
- Squatting increases venous return and systolic BP
  - Increases AS and MR, decreases HCM and MVP



# Maneuvers

- **Post PVC**
  - makes AS and HCM louder
  - MR is unchanged
- **Handgrip**
  - Have patient squeeze tennis ball without valsalva
  - Makes AS, HCM, MVP quieter, MR louder





# Heart Rhythm

- Sinus rhythm may be associated with significant respiratory variability
- If irregular, is it irregularly or regularly irregular?
- PVCs tend to be followed by a pause. Next pulse is augmented in amplitude (except in HCM)
- PACs often don't have pause
- Ventricular tachycardia has variable S1 intensity



# Conclusions

- Cardiac physical exam founded on
  - Understanding of the cardiac cycle
  - Careful history
- Patients with murmurs or abnormal PE and dyspnea, syncope, chest pain need prompt cardiology evaluation
  - Consider echocardiography for all undiagnosed continuous, diastolic, or holosystolic murmurs
  - Grade III ejection murmurs or suspected HCM







# Hypertrophic Cardiomyopathy

- Autosomal dominant disorder of myosin
  - Variable penetrance
- Leading cause of sudden death in athletes in US
  - Associated with syncope, chest pain, and dyspnea
  - Exercise associated syncope, chest pain





# HCM- PE findings

- Midsystolic ejection murmur due to transient obstruction of outflow in mid systole
  - Heard best at LLSB and apex (may have some MR as well)
  - Carotids have brisk upstroke but may have “double” peak (bisfuriens)
  - Murmur often much worse during valsalva or any maneuver to decrease venous return/increase contractility
  - Fourth sound usually present due to diastolic stiffness
  - Third sound often present as well

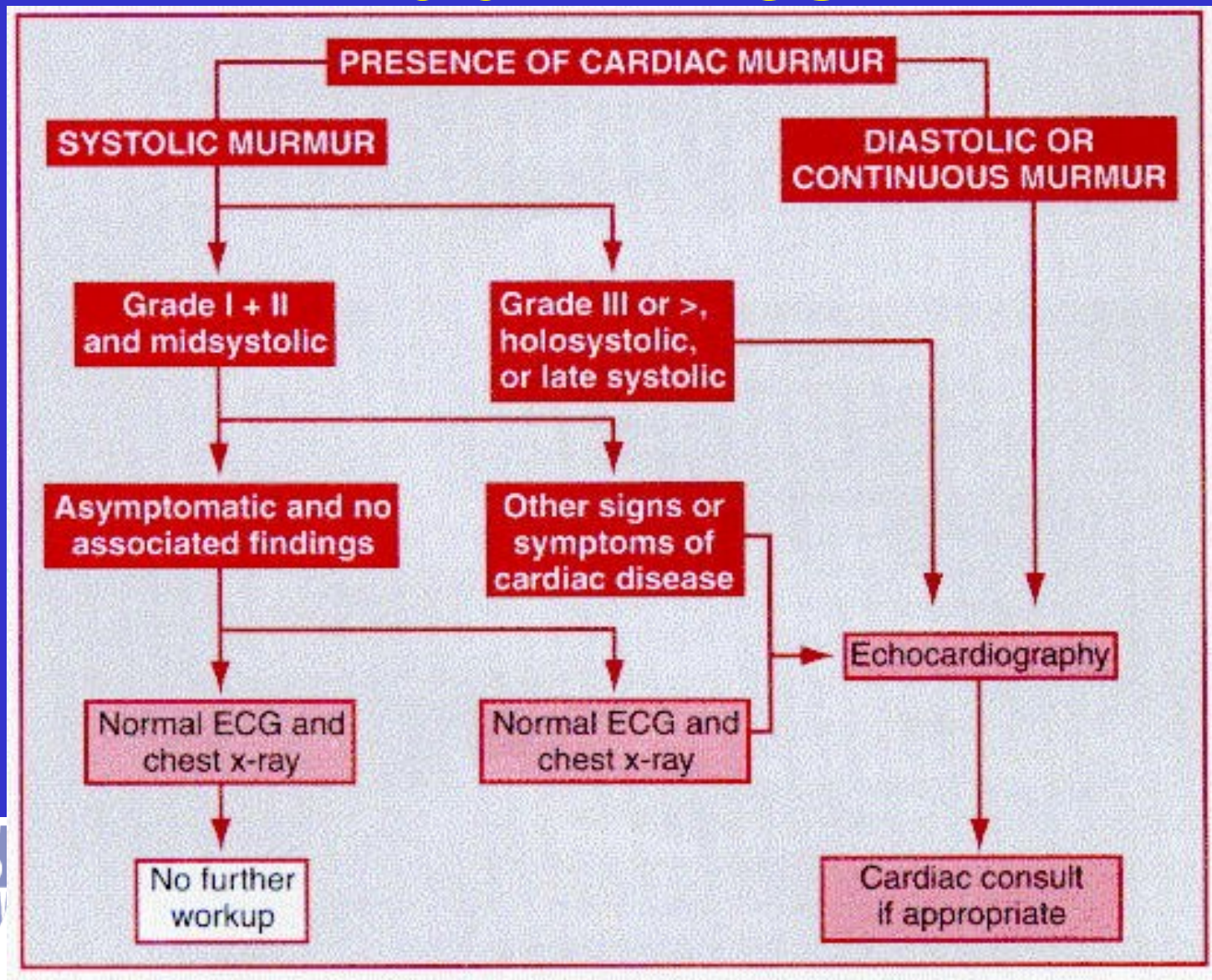


# HCM- Differential Dx

- HCM vs. Valvular Aortic Stenosis
  - Carotid upstrokes
  - Post-PVC make pulse smaller in HCM, larger in AS
  - Murmur location
  - Valsalva makes HCM louder, AS quieter



# Evaluating murmurs for dummies



# Valsalva and Heart Rate

